OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **SUNSET LAKE, ALTON** the program coordinators recommend the following actions. *These analyses are based upon a limited set of data of only one sample per summer. We recommend increasing the sampling frequency of the lake to once per month to ensure more accurate trend analyses.*

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *fairly stable* in-lake chlorophyll-a trend. There was only a slight increase in chlorophyll concentrations from last season, though the concentration is still well below the state mean for chlorophyll-a. Overall, algal abundance remains low for the lake with diatoms and golden-brown algae dominant in August. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *variable* trend in lake transparency. Transparency was slightly lower this season, which was likely caused by the breezy conditions and ripples on the water's surface. Water clarity in Sunset Lake has remained well above the average for New Hampshire lakes for over 10 years. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stable* trend for in-lake phosphorus levels. Phosphorus concentrations in the upper layer remained below the New Hampshire median this season. Hypolimnetic phosphorus concentrations were back to a normal level for the lake after two years of increasing concentrations. This is a desirable trend that we hope to see continue. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- As part of the state's lake trophic classification program, DES biologists performed a comprehensive lake survey on Sunset Lake. All public lakes in the state are surveyed every ten to fifteen years. In addition to the tests normally carried out by VLAP, biologists tested for common metals, nitrogen, created a map of the bottom contours of the lake (bathymetry), and mapped the abundance and distribution of aquatic plants along the shores. For a complete copy of the raw data from the survey, please contact the DES Biology Section at (603) 271-2963. A final report should be available in 2002 and a copy can be found at any state library.

- More precision in data analysis can be achieved by conducting more sampling events each summer. Since the figures showed variable trends among the parameters it would be a good idea to include at least one more sampling event each season. Weather patterns and activity in the watershed change throughout the course of the summer, and both of these can have effects on water quality. The watershed of Sunset Lake is highly developed on one side, so increasing the sampling of the lake would enable us to discover any possible sources of human-induced pollution.

- Conductivity levels continue to remain low throughout the watershed, however there was a slight increase of levels in the lake itself this year (Table 6). The increase was not excessive and does not indicate the presence of any pollution. However, the lake was only sampled once, and the data only represent what was taking place at that time of the summer.

- The Inlet continues to have low total phosphorus concentrations (Table 8). We will continue to watch the water quality at this site.

- Dissolved oxygen was again high throughout the water column (Table 9). As stratified lakes age, oxygen is depleted in the lower layer by the process of decomposition. The lack of this aging indicator is a sign of the lake's overall health.

- *E. coli* originates in the intestines of warm-blooded animals (including humans) and is an indicator of associated and potentially harmful pathogens. Bacteria concentrations were low at the sites tested (Table 12). If residents are concerned about septic system impacts, testing when the water table is high or after rains is best. Please consult the Other Monitoring Parameters section of the report for the current standards for *E. coli* in surface waters.

USEFUL RESOURCES

Comprehensive Shoreland Protection Act, RSA 483-B, WD-BB-35, NHDES Fact Sheet. (603) 271-3503 or www.state.nh.us

Bacteria in Surface Waters, WD-BB-14, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

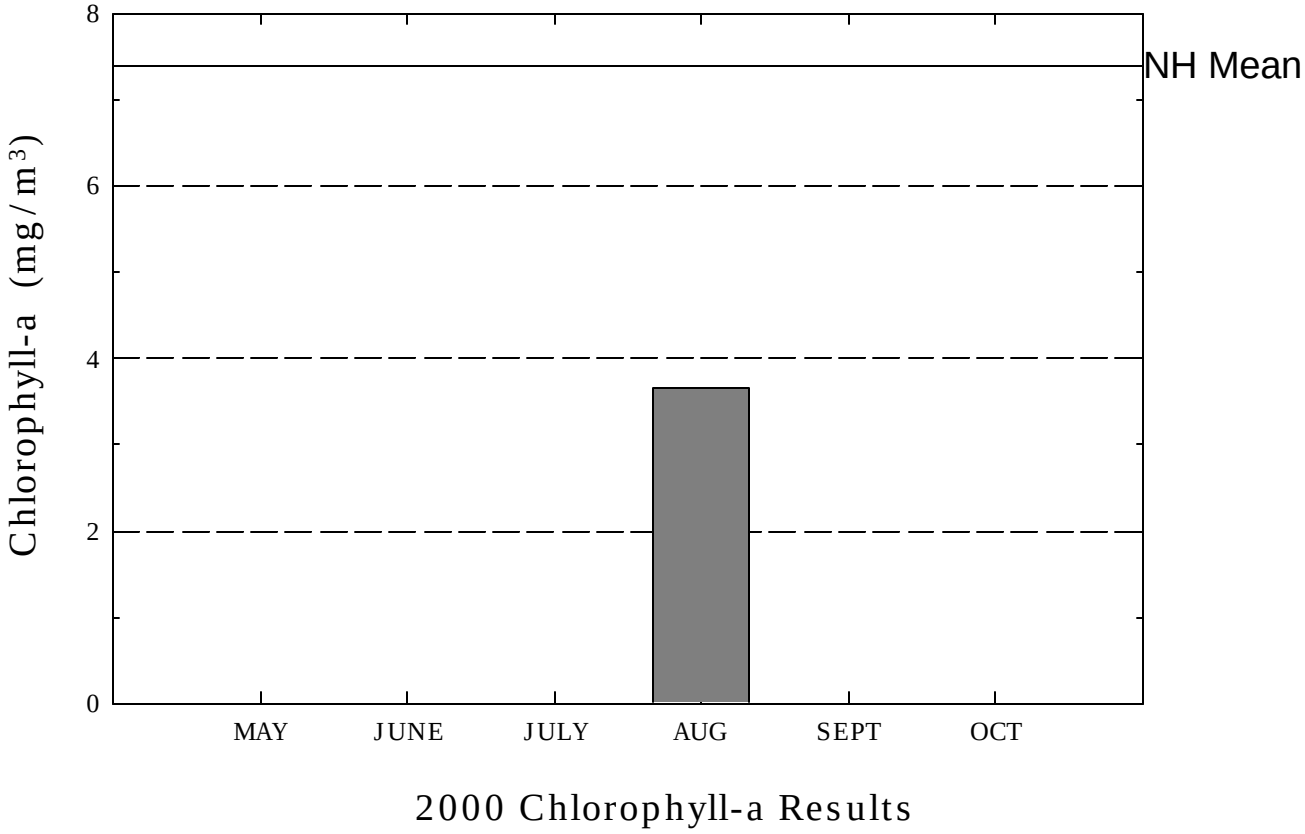
A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

Proper Lawn Care Can Protect Waters, WD-BB-31, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

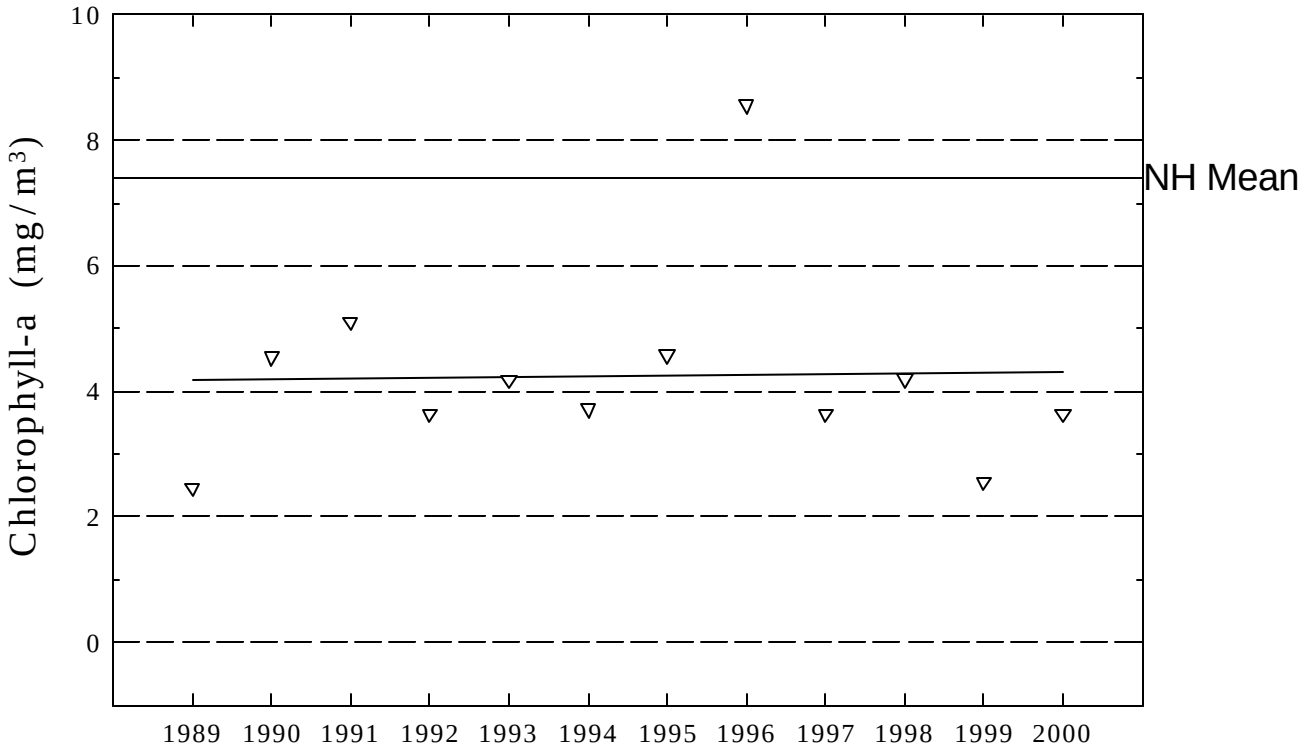
Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

Sunset Lake, Alton

Figure 1. Monthly and Historical Chlorophyll-a Results



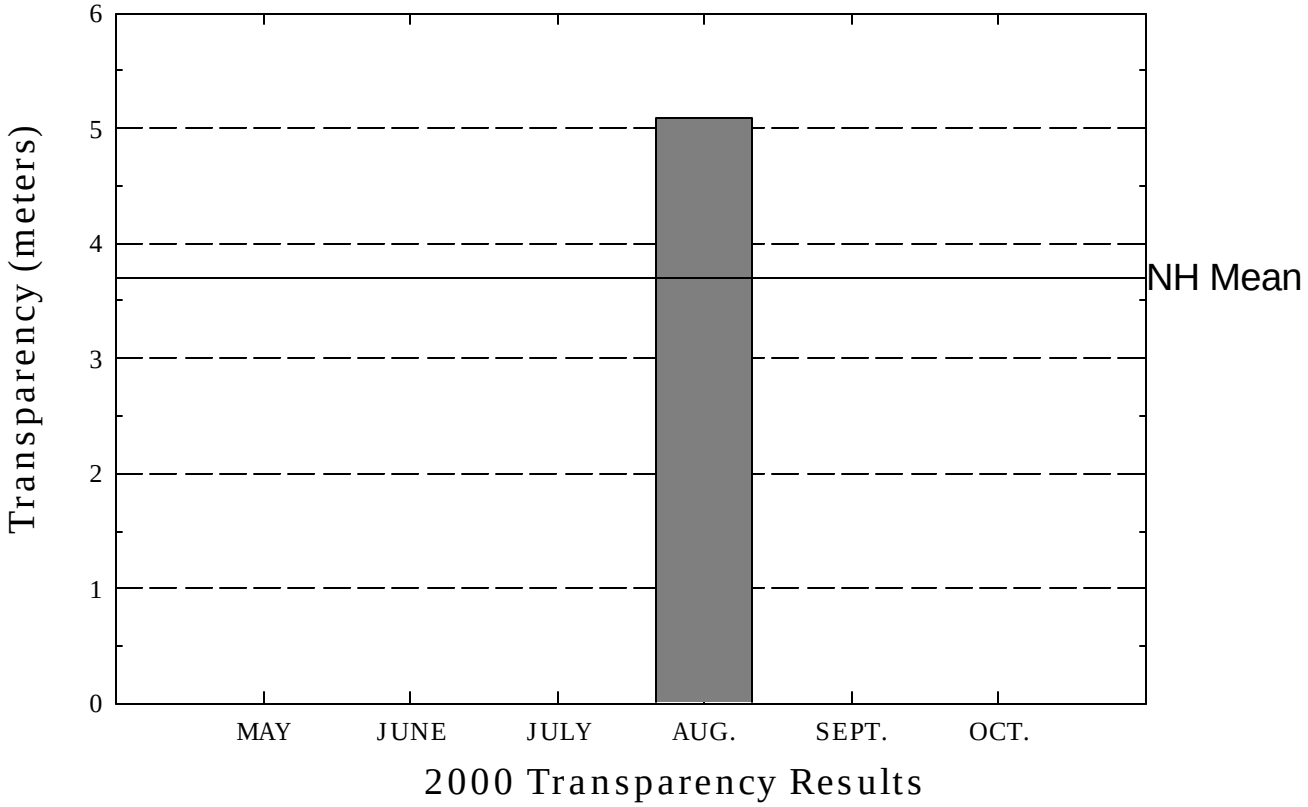
2000 Chlorophyll-a Results

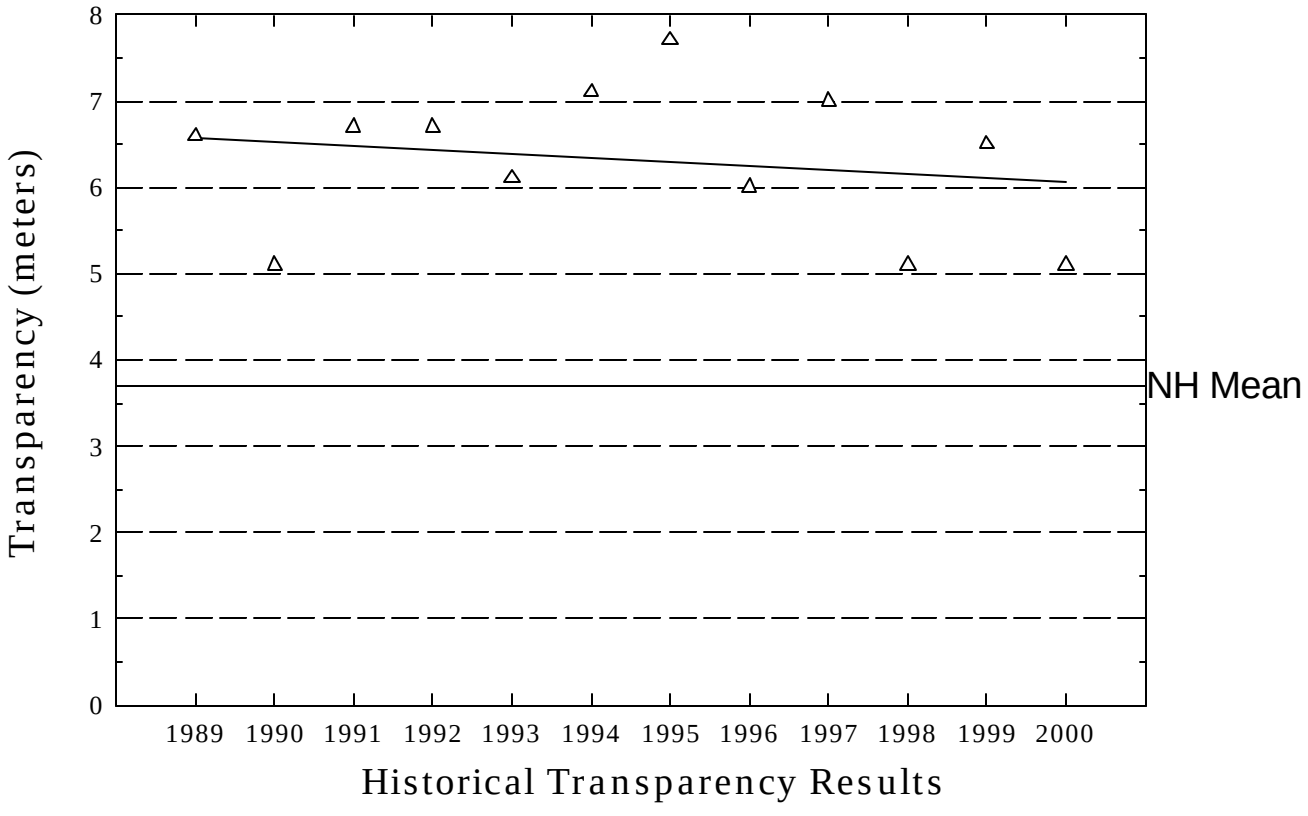


Historical Chlorophyll-a Results

Sunset Lake, Alton

Figure 2. Monthly and Historical Transparency Results





Sunset Lake, Alton

Figure 3. Monthly and Historical Total Phosphorus Data.

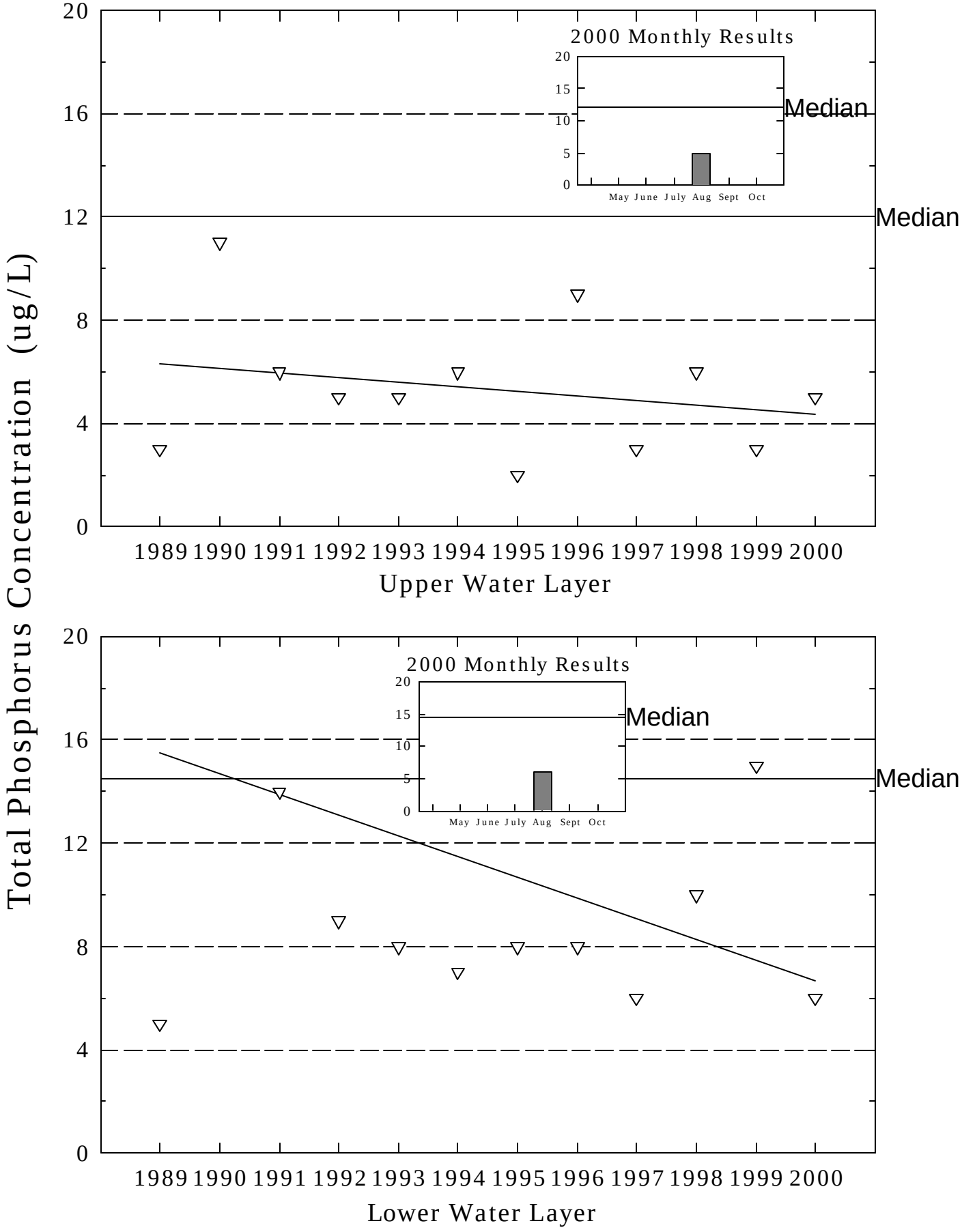


Table 1.

SUNSET LAKE

ALTON

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1989	2.46	2.46	2.46
1990	4.55	4.55	4.55
1991	5.10	5.10	5.10
1992	3.65	3.65	3.65
1993	4.19	4.19	4.19
1994	3.72	3.72	3.72
1995	4.58	4.58	4.58
1996	8.57	8.57	8.57
1997	3.65	3.65	3.65
1998	4.20	4.20	4.20
1999	2.56	2.56	2.56
2000	3.65	3.65	3.65

Table 2.

SUNSET LAKE

ALTON

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
08/01/1989	DINOBRYON	59
	TABELLARIA	
	CHRYSOSPHAERELLA	
08/01/1990	CHRYSOSPHAERELLA	87
08/12/1991	SYNURA	42
	ASTERIONELLA	30
	CHRYSOSPHAERELLA	14
08/10/1992	ASTERIONELLA	26
	TABELLARIA	24
	SYNURA	24
08/02/1993	CHRYSOSPHAERELLA	14
	SYNURA	48
08/04/1994	STAURASTRUM	38
	TABELLARIA	14
	SYNURA	10
07/31/1995	CHRYSOSPHAERELLA	58
	SYNURA	11
	TABELLARIA	10
07/29/1996	CHRYSOSPHAERELLA	26
	ASTERIONELLA	23
	RHIZOSOLENIA	18
08/04/1997	SYNURA	54
	DINOBRYON	30
	RHIZOSOLENIA	5
08/03/1998	DINOBRYON	32
	ASTERIONELLA	21
	CHRYSOSPHAERELLA	20
08/02/1999	CHRYSOSPHAERELLA	48
	STAURASTRUM	14
	RHIZOSOLENIA	12

Table 2.

SUNSET LAKE

ALTON

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
08/03/2000	RHIZOSOLENIA	36
	DINOBRYON	33
	TABELLARIA	8

Table 3.

SUNSET LAKE

ALTON

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1989	6.6	6.6	6.6
1990	5.1	5.1	5.1
1991	6.7	6.7	6.7
1992	6.7	6.7	6.7
1993	6.1	6.1	6.1
1994	7.1	7.1	7.1
1995	7.7	7.7	7.7
1996	6.0	6.0	6.0
1997	7.0	7.0	7.0
1998	5.1	5.1	5.1
1999	6.5	6.5	6.5
2000	5.1	5.1	5.1

Table 4.

SUNSET LAKE

ALTON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
BEACH				
	1994	6.88	6.88	6.88
EPILIMNION				
	1989	6.83	6.83	6.83
	1990	6.81	6.81	6.81
	1991	6.80	6.80	6.80
	1992	6.85	6.85	6.85
	1993	6.86	6.86	6.86
	1994	6.83	6.83	6.83
	1995	6.62	6.62	6.62
	1996	6.29	6.29	6.29
	1997	6.74	6.74	6.74
	1998	6.62	6.62	6.62
	1999	6.63	6.63	6.63
	2000	6.59	6.59	6.59
HYPOLIMNION				
	1989	5.98	5.98	5.98
	1990	6.29	6.29	6.29
	1991	6.20	6.20	6.20
	1992	6.26	6.26	6.26
	1993	5.84	5.84	5.84
	1994	5.94	5.94	5.94
	1995	5.98	5.98	5.98
	1996	5.81	5.81	5.81
	1997	5.93	5.93	5.93
	1998	5.79	5.79	5.79
	1999	5.93	5.93	5.93

Table 4.

SUNSET LAKE

ALTON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	2000	6.00	6.00	6.00
INLET				
	1990	6.10	6.10	6.10
	1993	6.92	6.92	6.92
	1994	6.37	6.37	6.37
	1995	6.11	6.11	6.11
	1996	5.89	5.89	5.89
	1997	6.50	6.50	6.50
	1998	6.01	6.01	6.01
	1999	5.98	5.98	5.98
	2000	6.06	6.06	6.06
METALIMNION				
	1989	6.46	6.46	6.46
	1990	6.45	6.45	6.45
	1991	6.70	6.70	6.70
	1992	6.37	6.37	6.37
	1993	6.17	6.17	6.17
	1994	6.47	6.47	6.47
	1995	6.18	6.18	6.18
	1996	5.88	5.88	5.88
	1997	6.44	6.44	6.44
	1998	6.02	6.02	6.02
	1999	6.10	6.10	6.10
	2000	6.13	6.13	6.13
OUTLET				
	1989	6.79	6.79	6.79
	1990	6.90	6.90	6.90

Table 4.

SUNSET LAKE

ALTON

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1991	6.80	6.80	6.80
	1993	7.20	7.20	7.20
	1994	6.78	6.78	6.78
	1995	6.68	6.68	6.68
	1996	6.28	6.28	6.28

Table 5.

SUNSET LAKE

ALTON

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1989	3.50	3.50	3.50
1990	3.20	3.20	3.20
1991	3.40	3.40	3.40
1992	3.80	3.80	3.80
1993	2.70	2.70	2.70
1994	3.30	3.30	3.30
1995	3.60	3.60	3.60
1996	3.50	3.50	3.50
1997	3.00	3.00	3.00
1998	2.70	2.70	2.70
1999	4.20	4.20	4.20
2000	3.60	3.60	3.60

Table 6.

SUNSET LAKE

ALTON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
BEACH				
	1994	75.2	75.2	75.2
EPILIMNION				
	1989	25.7	25.7	25.7
	1990	24.6	24.6	24.6
	1991	25.0	25.0	25.0
	1992	26.1	26.1	26.1
	1993	22.8	22.8	22.8
	1994	27.5	27.5	27.5
	1995	26.7	26.7	26.7
	1996	27.7	27.7	27.7
	1997	25.4	25.4	25.4
	1998	25.3	25.3	25.3
	1999	28.7	28.7	28.7
	2000	29.3	29.3	29.3
HYPOLIMNION				
	1989	26.0	26.0	26.0
	1990	25.1	25.1	25.1
	1991	25.8	25.8	25.8
	1992	27.4	27.4	27.4
	1993	21.9	21.9	21.9
	1994	27.9	27.9	27.9
	1995	26.9	26.9	26.9
	1996	28.8	28.8	28.8
	1997	26.4	26.4	26.4
	1998	29.0	29.0	29.0
	1999	28.8	28.8	28.8

Table 6.

SUNSET LAKE

ALTON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	2000	30.1	30.1	30.1
INLET				
	1990	29.1	29.1	29.1
	1993	23.0	23.0	23.0
	1994	27.9	27.9	27.9
	1995	29.9	29.9	29.9
	1996	28.6	28.6	28.6
	1997	25.7	25.7	25.7
	1998	26.3	26.3	26.3
	1999	33.8	33.8	33.8
	2000	27.0	27.0	27.0
METALIMNION				
	1989	25.6	25.6	25.6
	1990	24.8	24.8	24.8
	1991	24.6	24.6	24.6
	1992	27.1	27.1	27.1
	1993	21.8	21.8	21.8
	1994	26.9	26.9	26.9
	1995	27.3	27.3	27.3
	1996	29.9	29.9	29.9
	1997	25.0	25.0	25.0
	1998	29.0	29.0	29.0
	1999	28.6	28.6	28.6
	2000	29.7	29.7	29.7
OUTLET				
	1989	25.7	25.7	25.7
	1990	24.4	24.4	24.4

Table 6.

SUNSET LAKE

ALTON

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1991	25.0	25.0	25.0
	1993	22.8	22.8	22.8
	1994	27.4	27.4	27.4
	1995	27.2	27.2	27.2
	1996	27.5	27.5	27.5

Table 8.

SUNSET LAKE

ALTON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1989	3	3	3
	1990	11	11	11
	1991	6	6	6
	1992	5	5	5
	1993	5	5	5
	1994	6	6	6
	1995	2	2	2
	1996	9	9	9
	1997	3	3	3
	1998	6	6	6
	1999	3	3	3
	2000	5	5	5
HYPOLIMNION				
	1989	5	5	5
	1990	37	37	37
	1991	14	14	14
	1992	9	9	9
	1993	8	8	8
	1994	7	7	7
	1995	8	8	8
	1996	8	8	8
	1997	6	6	6
	1998	10	10	10
	1999	15	15	15
	2000	6	6	6

Table 8.

SUNSET LAKE

ALTON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
INLET				
	1990	45	45	45
	1993	5	5	5
	1994	8	8	8
	1995	13	13	13
	1996	11	11	11
	1997	11	11	11
	1998	11	11	11
	1999	9	9	9
	2000	8	8	8
METALIMNION				
	1989	6	6	6
	1990	14	14	14
	1991	13	13	13
	1992	8	8	8
	1993	8	8	8
	1994	10	10	10
	1995	10	10	10
	1996	9	9	9
	1997	11	11	11
	1998	7	7	7
	1999	11	11	11
	2000	6	6	6
OUTLET				
	1989	2	2	2
	1990	5	5	5
	1991	10	10	10

Table 8.

SUNSET LAKE

ALTON

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1993	4	4	4
	1994	3	3	3
	1995	1	1	1
	1996	6	6	6

Table 9.

SUNSET LAKE

ALTON

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
		August 3, 2000	
0.1	21.8	7.8	88.4
1.0	21.5	7.8	88.5
2.0	21.4	7.9	89.1
3.0	21.1	7.8	87.8
4.0	20.9	7.9	87.9
5.0	20.8	7.8	86.8
6.0	17.6	8.3	87.2
7.0	14.0	7.9	76.9
8.0	11.6	7.2	66.2
9.0	10.0	7.2	63.5
10.0	8.8	7.0	59.9
11.0	8.2	7.0	59.3
12.0	7.8	6.7	56.1
13.0	7.6	6.5	54.3
14.0	7.5	6.6	55.1
15.0	7.5	6.5	54.1
16.0	7.6	6.2	52.1
17.0	7.1	5.3	43.8
18.0	7.1	4.4	36.1
19.0	7.1	3.3	27.4
20.0	7.1	2.8	23.0
21.0	7.8	2.2	18.1

Table 10.

SUNSET LAKE

ALTON

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
August 1, 1989	20.0	5.5	6.5	50.0
August 1, 1990	23.0	4.6	5.4	41.8
August 12, 1991	25.5	5.9	1.1	8.8
August 10, 1992	16.5	5.2	7.1	55.7
August 2, 1993	23.0	5.3	1.8	14.0
August 4, 1994	17.0	5.2	6.2	48.0
July 31, 1995	22.0	5.2	4.7	36.0
July 31, 1995	22.0	5.2	4.7	36.0
July 29, 1996	24.0	4.7	5.7	43.0
August 4, 1997	23.0	5.5	2.9	22.0
August 3, 1998	21.0	5.2	5.0	38.0
August 2, 1999	23.0	6.5	2.1	16.7
August 3, 2000	21.0	7.8	2.2	18.1

Table 11.

SUNSET LAKE
ALTON

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
EPILIMNION				
	1993	0.0	0.0	0.0
	1997	0.1	0.1	0.1
	1998	0.2	0.2	0.2
	1999	0.3	0.3	0.3
	2000	0.3	0.3	0.3
HYPOLIMNION				
	1993	0.0	0.0	0.0
	1997	1.0	1.0	1.0
	1998	0.3	0.3	0.3
	1999	0.6	0.6	0.6
	2000	0.2	0.2	0.2
INLET				
	1993	0.0	0.0	0.0
	1997	0.4	0.4	0.4
	1998	0.3	0.3	0.3
	1999	0.4	0.4	0.4
	2000	0.3	0.3	0.3
METALIMNION				
	1993	0.0	0.0	0.0
	1997	0.4	0.4	0.4
	1998	0.5	0.5	0.5
	1999	0.3	0.3	0.3
	2000	0.3	0.3	0.3
OUTLET				
	1993	0.0	0.0	0.0

Table 12.

SUNSET LAKE

ALTON

Summary of current year bacteria sampling.
Results in counts per 100ml.

Location	Date	E. Coli See Note Below
INLET		
	August 3	3

NOTE: "<" means "less than" and ">" means "greater than"